

REMARKS

Entry of the foregoing, examination and consideration of the subject matter identified in caption, as amended, are respectfully requested.

If there are any questions concerning this paper or the application in general, the Examiner is invited to telephone the undersigned at the Examiner's earliest convenience.

Respectfully submitted,

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Paragraph beginning at page 3, line 14:

The invention according to [claim 1] one aspect thereof relates to the aqueous lubricant itself, in which the aqueous lubricant comprises a metal chelate compound suspended or dispersed in water. The metal chelate compound described herein comprises a polydentate or multidentate chelate ligand in which at least one of the coordinating atoms is sulfur, coordinated to a coordination site of at least one metal species selected from among zinc, manganese, iron, molybdenum, tin and antimony. For the purposes of this explanation, the term "suspension" is intended to mean a metal chelate compound distributed in water, for example, by continuous stirring. The term "dispersion" is intended to mean a metal chelate compound distributed in water without precipitation, by use of a surfactant or the like. Anionic and non-ionic surfactants are suitable for dispersion of the metal chelate compounds in water.

Paragraph beginning at page 5, line 5:

The invention according to [claim 2] another aspect thereof relates to chemical substances particularly suited for production of the aqueous lubricant. The chemical substances are multi-ligand metal chelate compounds, in which a polydentate or multidentate chelate ligand having sulfur as at least one of the coordinating atoms coordinates by partially filling the multiple coordination sites of the one or more metal species selected from among zinc, manganese, iron, molybdenum, tin and antimony, whereas ligands that do not have sulfur as a coordinating atom coordinate to the remaining coordination sites. That is, the chelate ligand is characterized as

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having sulfur as a coordinating atom that does not fill all the coordination sites of the metals, so that it is not coordinated to some of the coordination sites. When the multi-ligand metal chelate compound is used as an aqueous lubricant suspended or dispersed in water, a very satisfactory lubricating film is produced.

Paragraph beginning at page 5, line 21:

The invention according to [claim 3] another aspect thereof also relates to a chemical substance particularly suited for production of the aqueous lubricant. The chemical substance is characterized in that a chelate ligand having sulfur as a coordinating atom is coordinated to some of the multiple coordination sites of the metal, whereas a hydroxide ion, condensed phosphate, polycarboxylic high molecular activator and/or polyoxycarboxylic acid are coordinated to the remaining coordination sites.

Paragraph beginning at page 6, line 13:

The aqueous lubricant according to [claim 5] another aspect thereof has a soluble condensed phosphate salt, a soluble polycarboxylic high molecular activator and/or a soluble polyoxycarboxylic acid salt added to the aforementioned aqueous lubricant. Addition of these adjuvants improves the performance of the lubricating film. A soluble condensed phosphate salt will associate with the surfactant present in the system, thus increasing the dispersability of the metal chelate compound that forms hydrophobic fine particles. A soluble polycarboxylic high

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molecular activator or soluble polyoxycarboxylic acid salt will increase the adhesion of the lubricating film to the metal surface. Using an aqueous lubricant containing such adjuvants will allow more intense heavy working.

Paragraph beginning at page 7, line 1:

The invention according to [claim 6] another aspect thereof relates to a process of forming a lubricating film on a phosphate film using an aqueous solution, if the phosphate film had already been formed on a metal surface. In this process, a metal material on which the phosphate film has already been formed is immersed in an aqueous solution of a multidentate or polydentate chelate ligand having sulfur as at least one of the coordinating atoms, so that the chelate ligand reacts with the zinc ion and/or iron ion in the phosphate film to produce a crystalline multi-ligand metal chelate compound on the phosphate film. This process takes advantage of both the lubricating effect of the phosphate film and the lubricating action of the metal chelate compound, in which sulfur is a coordinating atom chelated to the zinc ion and/or iron ion.

Paragraph beginning at page 7, line 14:

The invention according to [claim 7] another aspect thereof also relates to a process of forming a lubricating film on a phosphate film. In this process, the phosphate film is formed on a metal material and the metal material is then immersed in an aqueous lubricant according to

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[claim 4 or 5] other aspects of the invention. A ligand, which is not a ligand having sulfur as a coordinating atom, reacts with the zinc ion and/or iron ion in the phosphate film to produce a crystalline polynuclear metal chelate compound on the phosphate film. This process takes advantage of both the lubricating effect of the phosphate film and the lubricating action of the metal chelate compound, in which sulfur is a coordinating atom chelated to a metal.

Paragraph beginning at page 8, line 1:

The invention according to [claim 8] another aspect thereof relates to a method of using the aqueous lubricant, in which prior to plastic working of the metal material, an aqueous lubricant according to [claim 1, 4 or 5] other aspects of the invention is applied onto either or both surfaces of the metal material and the molding surface of the metal mold to form lubricating films on those surfaces, thus allowing plastic working of the metal material with a lubricating film formed on the surface.